Habitat Limiting Factors and Reconnaissance Assessment Report

Executive Summary

Green/Duwamish and Central Puget Sound Watersheds

(Water Resource Inventory Area 9 and Vashon Island)

December 2000

KING COUNTY

Washington State Conservation Commission

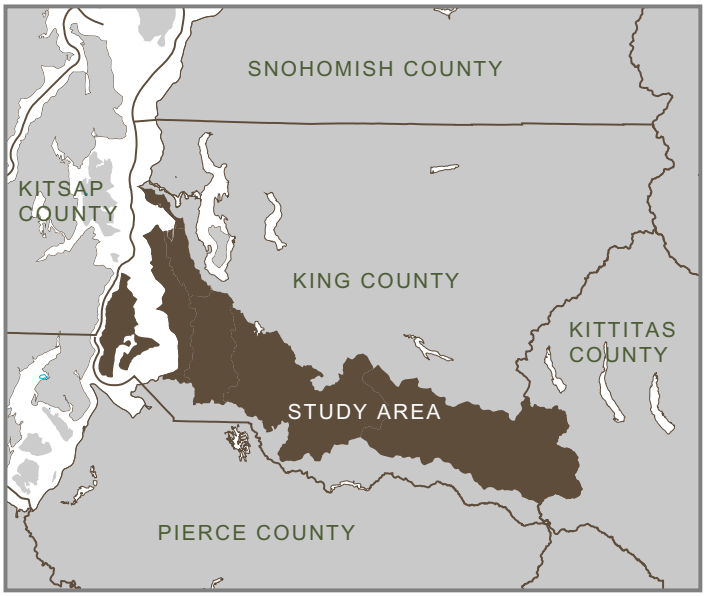
I. INTRODUCTION

Many stocks of the wild salmonid populations in the Puget Sound ecoregion have declined. In March 1999, the National Marine Fisheries Service (NMFS) listed Puget Sound chinook salmon as a Threatened species under the Endangered Species Act (ESA). In November 1999, the U.S. Fish and Wildlife Service (USFWS) listed bull trout as a Threatened species under the ESA. Other populations and species are under consideration for listing as Threatened or Endangered under ESA.

The Habitat Limiting Factors and Reconnaissance Report

As a first step in the long-term commitment to salmonid recovery in Water Resource Inventory Area 9 (WRIA 9) and Vashon-Maury Islands, staff and representatives from the Washington Conservation Commission and the WRIA 9 Steering Committee worked together to develop the Habitat Limiting Factors and Reconnaissance Assessment Report. The purpose of this report is to provide a current snapshot in time of the existing salmonid species and the habitat conditions that limit the natural production of salmonids in the Green/Duwamish River watershed, the independent drainages to Puget Sound from Elliott Bay south to the Puyallup watershed, the drainages on Vashon-Maury Islands, and the nearshore. This area is collectively termed WRIA˚9 for the purposes of this report. This report:

- Provides a summary of what is known about current and past salmonid species and habitat conditions in the WRIA for future reference;
- Provides baseline information for the WRIA (based on currently available data) for use in the implementation of an adaptive management program;
- Identifies habitat limiting factors in the WRIA, key findings, and associated data gaps that will be used to build the WRIA 9 Salmonid Conservation Plan; and
- Provides preliminary guidance for policy makers to determine next steps and direct resources for the recovery process.



Focus on Habitat Limiting Factors

While the causes of declining salmonid populations can be attributed to many factors, this report focuses on human-controlled modification or destruction of saltwater nearshore and freshwater habitats and the changes to ecological processes that affect those habitats in WRIA 9.

Physical Description

The Green/Duwamish River is the largest freshwater component of WRIA 9. The Green/Duwamish mainstem is responsible for producing the eight major species of anadromous and resident salmonids present in the watershed. The Green/Duwamish River watershed begins in the Cascade Mountains about 30 miles northeast of Mount Rainier and flows for over 93 miles to Puget Sound at Elliott Bay in Seattle. It is bounded on the north by the Lake Washington watershed (WRIA 8) and to the south by the Puyallup watershed (WRIA 10). Historically, the White, Green, and Cedar (via the Black) Rivers flowed into the Duwamish River, and the system drained an area of over 1,600 square miles. Because of the diversion of the White River in 1911 and the Cedar River in 1916, the Green/Duwamish drainage area has been reduced to 556 square miles.

To help us better understand the Green/Duwamish watershed and WRIA 9, we have divided it into six geographic areas as shown in the corresponding map (see centerfold map on pages 8-9):

- Upper Green River Sub-watershed (River Mile 64.5 to 93+, Howard Hanson Dam to headwaters)
- Middle Green River Sub-watershed (River Mile 32.0 to 64.5, Highway 18 to Howard Hanson Dam)
- Lower Green River Sub-watershed (River Mile 11.0 to 32.0, Black River to Highway 18)
- Green/Duwamish River Estuary Sub-watershed (River Mile 0.0 to 11.0, Elliott Bay/Harbor Island to Black River)
- Nearshore Sub-watershed (independent tributaries to Puget Sound and Vashon-Maury Islands)
- Nearshore Sub-watershed (estuarine/marine waters and habitats)

These divisions make sense because of natural and/or anthropogenic landscape features. However, the sub-watersheds are all linked together as part of the larger ecosystem and by the processes necessary to support naturally produced salmonids.

Land Uses and History

Land uses differ considerably across the watershed and there are few watersheds in the Puget Sound basin that match the extremes evident in WRIA 9. In the Upper Green River Sub-watershed, land is devoted almost entirely to forest production. The Middle Green River Sub-watershed is characterized by a mix of residential, commercial forestry, and agricultural land uses. Residential, industrial, and commercial uses prevail in the Lower Green River Sub-watershed. The Green/Duwamish River Sub-watershed is split between residential and industrial uses. Independent tributaries to Puget Sound, including Vashon-Maury Islands, are primarily residential with small areas of commercial development and mining.

These land uses have emerged over the last 150 years, which have seen a number of other fundamental changes to the WRIA. Some of these major historical changes include:

- 1851 European settlement begins in the Duwamish River.
- 1880-1910 Logging occurs across much of the watershed and in the lower river valley; agricultural land use expands.
- 1911 White River is diverted from Green River to Puyallup River for flood control, reducing watershed area by 30 percent.
- 1913 City of Tacoma begins diverting water from Green River to provide water for homes and industry. Anadromous salmonids are blocked from Upper Green River Sub-watershed.
- 1916 Black and Cedar Rivers are diverted from Duwamish River to Lake Washington to improve navigation, further reducing watershed area by 40 percent from its original size.

- 1900-1940 Duwamish estuary tidelands are filled, drained, and dredged to support growing industrial and port activities.
- 1895-1980 The Green/Duwamish River is channelized and diked for navigation and flood control.
- 1945-2000 Residential, commercial, and industrial land uses expand, largely replacing farmlands and forests in the western half of the WRIA.
- 1962 Howard Hanson Dam is completed for flood control purposes.

Fish Status

Every species of anadromous salmonid that is native to the west coast of North America (coho, chinook, chum, sockeye, and pink salmon and coastal cutthroat, steelhead, and bull trout/Dolly Varden char) as well as one non-native (Atlantic salmon) recently have been found in the Green/Duwamish watershed.

During the period 1968-1997, the Green/Duwamish River supported an average yearly total run (fish returning to the river and those caught in the fisheries) of about 41,000 adult chinook salmon. It has been estimated that on average 5,700 chinook annually returned to the river to spawn naturally and 8,200 returned to the Soos Creek hatchery during the same time interval (Figure˚1). The Green River has not experienced the same decline in naturally spawning adult chinook that has occurred in other Puget Sound streams but these numbers may be masked by a high hatchery chinook stray rate onto the spawning grounds. Research is needed to better understand the contribution of strays to the wild chinook stocks in the Green/Duwamish watershed.

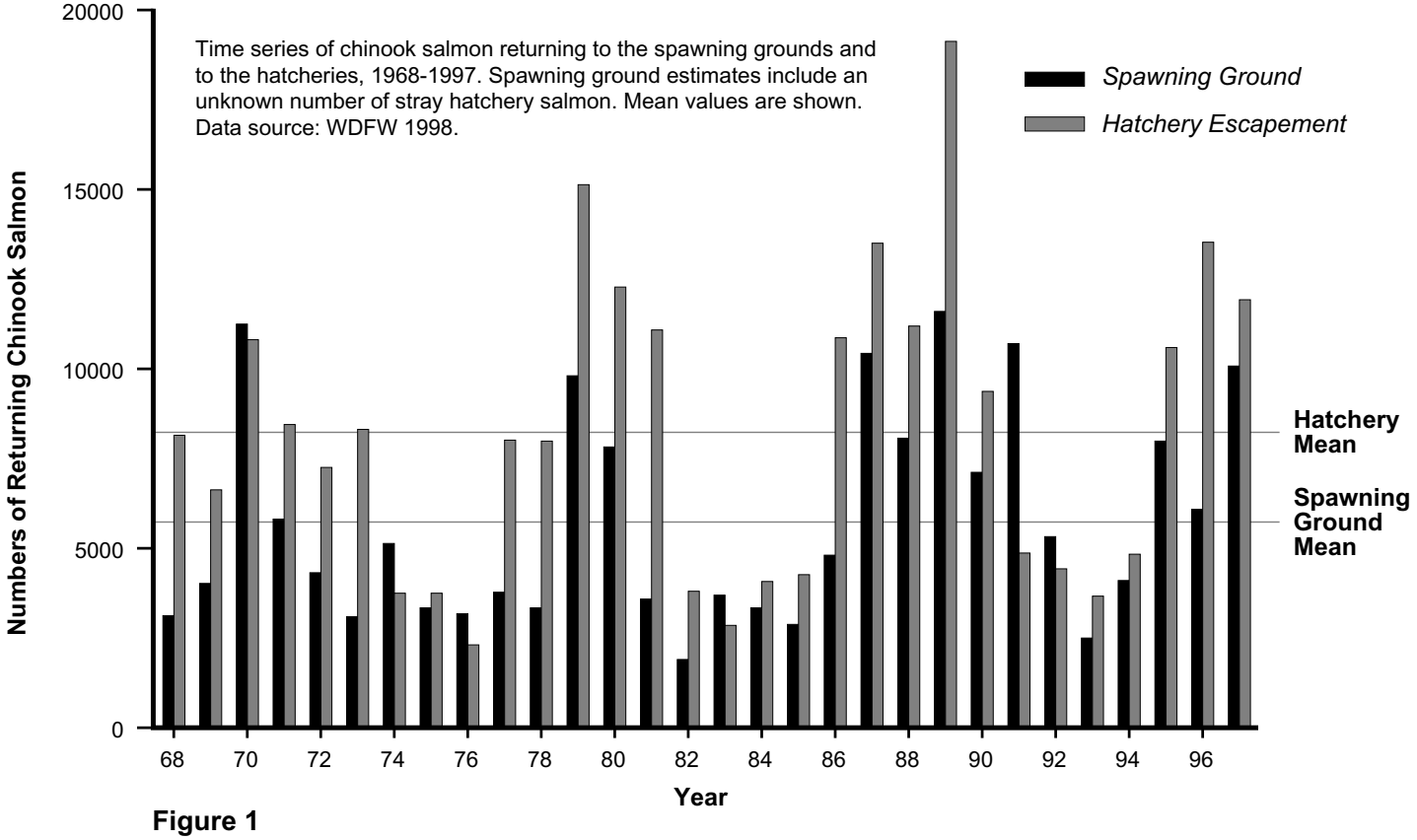


Figure 1
Returning Chinook Salmon to the Spawning Grounds and Hatcheries 1968-1997

III. INDIVIDUAL SUB-WATERSHED SYNOPSES

Upper Green River Sub-watershed
(RM 64.5 to headwaters)

Human population: 1

Primary designated land uses: forest production (nearly 100˚percent), municipal water supply, and recreation

Mean annual flow: about 1,300 cubic feet per second at River Mile 64.5

Recently documented salmonid species present: resident coastal cutthroat, transported juvenile steelhead, transported juvenile chinook, transported juvenile coho, and transported steelhead adults

Additional salmonid fish species historically present: chinook, coho, and bull trout (possible but not likely)

Anadromous fish access to the upper reaches of the Green/Duwamish River has been blocked at River Mile (RM) 61 since 1911 when the City of Tacoma started construction on a water diversion dam (Headworks). While the City of Tacoma has limited public access in a portion of the upper sub-watershed to protect the potable water supply, commercial timber harvest has occurred throughout this portion of the watershed. This activity has altered many of the ecological processes and degraded much of the habitat. Roads and a railroad also have had an impact on the mainstem as described below. Currently, only the resident form of coastal cutthroat and some anadromous salmonids that have been transported around the dams (juvenile steelhead trout, chinook and coho salmon, and adult winter steelhead trout) use this portion of the watershed.

In 1962, Howard Hanson Dam (HHD), a flood control dam, was completed at RM 64.5, which is the downstream boundary of this sub-watershed. HHD also is a complete barrier to upstream and downstream adult migration. The large flood control dam and associated reservoir interrupts the natural flow of sediments and large woody debris to lower mainstem reaches of the Green River. It also chronically floods upstream habitat.

Habitat Limiting Factors and Impacts

Mainstem Green River:

While the two dams block upstream passage and severely hamper downstream passage, some salmonids do reside in this reach and are affected by existing habitat conditions. If passage is improved in the future, existing habitat conditions will affect salmonids that are reintroduced to the area. These limiting habitat factors include:

The placement of roads and a railroad immediately adjacent to rivers and streams resulting in:

- Reduction and degradation of riparian habitat functions such as shade and large woody debris; and
- Limited lateral channel migration and limited creation of new habitat.

A reservoir pool that is:

- Reducing spawning habitat and riparian functions due to periodic inundation of 4.5 miles of the Green River mainstem and 3.0 miles of tributaries; and
- Delaying juvenile outmigration.

Tributaries:

Logging practices resulting in:

- Reduced riparian habitat functions such as shade and instream large woody debris;
- Fish passage barriers;
- Excessive sedimentation, especially of fine sediments;
- Decreased water quality; and
- Altered stream hydrology.

Middle Green River Sub-watershed
(RM 32.0 to 64.5)

Human population: 112,000

Primary designated land uses: residential (50 percent), commercial forestry (27 percent), agriculture (12 percent)

Mean annual flow: 1,300 to 2,000 cubic feet per second

Recently documented salmonid species present: chinook, coho, chum, pink, sockeye, steelhead, coastal cutthroat trout, and occasionally Atlantic salmon

Additional salmonid fish species historically present: bull trout (possible but not likely)

In the Middle Green River Sub-watershed (RM 64.5 to 32.0), the construction and operation of Howard Hanson Dam has reduced the recruitment of sediments to a level where the river is in places gravel-starved and incising. Because HHD serves to limit floods, the natural flow regime of the mainstem Geen River has been altered, harming habitat as described below. The Tacoma Headworks also block upstream passage of all salmonids. Currently chinook, steelhead, coastal cutthroat, coho, and chum utilize this reach up to the Headworks for spawning and rearing. There are limited numbers of pink and sockeye salmon as well an occasional observation of Atlantic salmon adults. All species, with the exception of Atlantic salmon, use this reach of the mainstem for migration and feeding.

Habitat Limiting Factors and Impacts

Mainstem Green River:

Dams, revetments, and residential and agricultural land uses that are:

- Changing the natural flow regime in ways that have harmed salmonids;
- Causing gravel starvation and scouring;
- Reducing the amount and size of large woody debris with a consequent reduction of channel complexity;
- Reducing side-channel and other off-channel habitats; and
- Reducing and degrading riparian habitat functions.

Tributaries:

Residential, agricultural, and some urban development that are:

- Reducing and degrading wetland and riparian functions;
- Reducing forest cover and increasing impervious surfaces leading to hydrologic disruption to stream flow, channel degradation, increased sedimentation, and decreased water quality;
- Rechanneling streams and limiting their lateral migration to facilitate roads and protect property;
- Reducing the amount and size of large woody debris;
- Creating barriers to fish passage; and
- Introducing non-native plant and animal species.


Nearshore
Sub-watershed
Elliott
Bay
SEATTLE
Green/Duwamish
Estuary Sub-watershed
Duwamish River
SEATTLE
99
5
900
TUKWILA
509
BURIEN
405
RENTON
Puget Sound
Vashon
Island
NORMANDY
PARK
SEATAC
167
515
DES
MOINES
KENT
COVINGTON
MAPLE
VALLEY
516
Maury Island
99
5
FEDERAL
WAY
167
AUBURN
Soos Creek
Lake
Sawyer
BLACK
DIAMOND
18
164
ALGONA
GREEN
RIVER
169
Newaukum Creek
ENUMCLAW
Vashon
Sub-watershed
Nearshore
Sub-watershed
Lower
Green River
Sub-watershed
Middle
Green River
Sub-watershed
N
0
2
4
6 Miles

April 2000

WRIA 9 Watershed

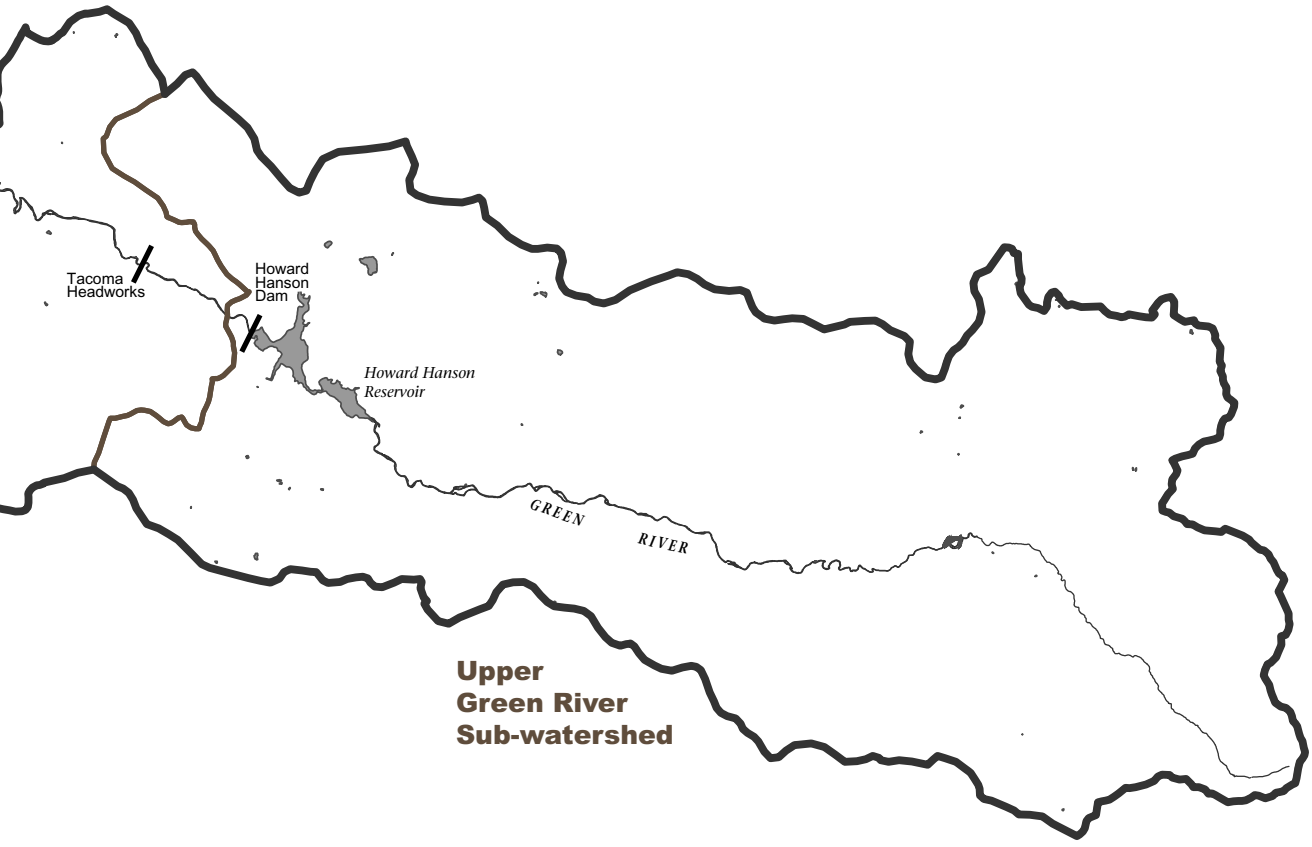
Major Road

River/Stream

Sub-watershed Boundary

King County WRIA 9 Boundary

Open Water



Lower Green River Sub-watershed
(RM 11.0 to 32.0)

Human population: 154,000

Primary designated land uses: residential (50 percent), industrial (17 percent), and commercial (10 percent)

Mean annual discharge: over 2,000 cubic feet per second

Recently documented salmonid species present: chinook, coho, chum, pink, sockeye, steelhead, coastal cutthroat trout, and occasionally Atlantic salmon

Additional salmonid fish species historically present: bull trout (possible but not likely)

In the Lower Green River Sub-watershed (RM 32.0 to 11.0), the diversion of the White River in 1911 has led to a decrease in flow and sediment and a lowering of the floodplain. Howard Hanson Dam operations and water withdrawal at the Tacoma Headworks have led to an unnatural flow regime (reduction in flood flows and lower summer flows). One of the most significant habitat alterations has been the construction of a series of revetments that has resulted in the disconnection of off- and side-channel habitats such as sloughs and adjacent wetlands. Currently this reach is utilized for the upstream and downstream migration and rearing for all native anadromous salmonid species. It provides some chinook, pink, sockeye, and chum salmon and steelhead spawning habitat.

Habitat Limiting Factors and Impacts

Mainstem Green River:

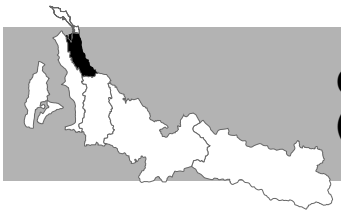
Urbanization, water diversions, and revetments that are:

- Lowering the floodplain and disconnecting off-channel habitats such as sloughs and adjacent wetlands;
- Reducing large woody debris and associated instream complexity, such as pools and riffles;
- Creating some adult salmon migration problems due to low flows;
- Causing chronic water quality problems; and
- Severely reducing riparian habitats and associated functions.

Tributaries:

Intense urbanization and infrastructure that are:

- Reducing forest cover and increasing impervious surfaces leading to hydrologic disruptions to stream flow, channel degradation, increased sedimentation, and decreased water quality;
- Channelizing streams to facilitate land use practices;
- Creating barriers to fish passage; and
- Introducing non-native plant and animal species.



Green/Duwamish Estuary Sub-watershed
(RM 0.0 to 11.0)

Human population: 58,000

Primary designated land uses: industrial (43 percent) and residential (39 percent)

Mean annual discharge: tidally influenced reach although more than 2,000 cubic feet per second of freshwater

Recently documented salmonid species present: chinook, coho, chum, pink, sockeye, steelhead, coastal cutthroat, adult bull trout/Dolly Varden char, and occasionally Atlantic salmon

The Duwamish River is that portion of the Green River downstream of the historic confluence with the Black River. With the diversion of the Cedar River in 1916, the Black River was left almost dry. Today, the only flow in the Black River comes from the tributary streams that drain from the eastern bluffs of the lower Green River valley.

The urbanization and industrialization of this portion of the Green River watershed has resulted in an extensive system of filled tidelands and flood control revetments that have eliminated connectivity to the historic floodplain, stream channel complexity, functioning riparian zones, and floodplain habitats. In the Duwamish estuary, over 97 percent of the historic estuarine mudflats, marshes, and forested riparian swamps have been eliminated by channel straightening, draining, dredging, and filling. All (100˚percent) of the tidal swamps bordering the Duwamish were filled by 1940. The remaining shortened channel has been simplified and suffers from polluted sediments along with stormwater and wastewater effluent. Currently all salmonid species migrate, rear, and acclimate in this transitional area between river and marine waters. Juvenile chinook and chum salmon are most dependent on this type of habitat. Small numbers of char (bull trout/Dolly Varden char) have been consistently documented as using this reach.

There are numerous small- and medium-sized tributary streams that drain into this reach. All have seen aggressive development that in turn has made many of them inaccessible and inhospitable for salmonids. Many of these streams have high levels of impervious surfaces that have degraded and altered the historic hydrologic regime. Most of the small patches of remaining marginal habitat are disconnected and heavily impacted by stormwater-associated flows and poor water quality. Functional riparian areas have been eliminated or fragmented into a few undeveloped areas, often in the high gradient reaches where the creeks cascade down the valley walls. The potential salmonid production of these creeks is expected to continue to be limited due to current land use practices.

Habitat Limiting Factors and Impacts

Mainstem Duwamish River/Waterway:

Urban and industrial land use practices that have:

- Dredged, channelized, and filled 97 percent of the estuarine mudflats, marshes, and forested riparian swamps that formerly comprised the estuary;
- Simplified the remaining channel and severely reduced riparian function; and
- Polluted the remnant, shortened channel with stormwater and wastewater effluent.

Tributaries:

Development that is:

- Creating fish passage barriers;
- Leaving small patches of disconnected marginal habitat;
- Altering hydrology and channel stability due to stormwater-associated flows; and
- Reducing water quality.

Nearshore Sub-watershed
(Independent Tributaries to Puget Sound and Vashon-Maury Islands)

Human population: 241,000

Primary designated land uses: on mainland: residential (68˚percent), industrial (10 percent); on Vashon-Maury Islands: residential (90 percent)

Recently documented salmonid species present: chinook, coho, chum, and coastal cutthroat

Additional salmonid fish species historically present: unknown

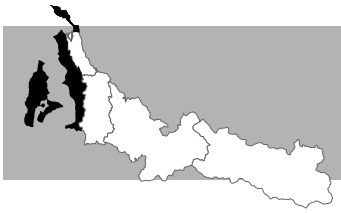
A number of independent streams in WRIA 9 drain directly into Puget Sound. Among the largest are Miller and Des Moines Creeks on the mainland. Vashon-Maury Islands also host a number of direct drainages. With the exception of a few streams, most have small drainage areas and corresponding flows.

While a few of these streams are relatively intact and support small populations of salmonids, most are heavily impacted by urbanization and no longer function well to support salmonids.

Habitat Limiting Factors and Impacts

Urban and industrial land use practices that are:

- Creating fish passage barriers;
- Reducing the amount of large woody debris and channel complexity;
- Causing chronic water quality problems; and
- Simplifying the remaining channel and severely reducing riparian functions.



Nearshore Sub-watershed
(Estuarine/Marine Waters and Habitats)

Human population: see Nearshore Sub-watershed (page 12)

Primary designated land uses: see Nearshore Sub-watershed (page 12)

Recently documented fish species present: all species of juvenile and adult salmonids

The nearshore — the boundary between saltwater and land that stretches from beach bluffs out into the shallows of Puget Sound — provides an important link in the life history of salmonids. All anadromous salmonids use the nearshore for physiological transition, feeding, refuge, and as a migration route to and from the ocean. Most salmonid species are dependent upon the nearshore for juvenile rearing. Much of the greater Puget Sound estuary shoreline has been filled, armored, and developed. Extensive areas have been dredged to maintain navigation along piers and within marinas. The supply of beach sediment has been curtailed and water quality problems stemming from upland land use practices have affected nearshore habitats. It is estimated that marine riparian vegetation exists along only 11 percent of the WRIA 9 shoreline (excluding Vashon-Maury Islands). This affects not only salmonids produced in WRIA 9 watersheds but also those produced in other Puget Sound watersheds that use WRIA 9 shorelines for support during migration.

All migratory juvenile salmonids are dependent on healthy estuarine and nearshore environments. Some species, such as chinook, chum, and pink salmon, are more dependent on a healthy estuary environment for physiological transition and rearing prior to their ocean migration. Nearshore habitats produce important food items for all life stages of salmonids. Especially important are the forage fish (e.g., sand lance, surf smelt, and herring) that require this area to spawn and rear.

Habitat Limiting Factors and Impacts

Urban and industrial land use practices that are:

- Altering or destroying significant amounts of nearshore habitat;
- Interrupting critical habitat-forming processes;
- Fragmenting or destroying marine riparian corridors; and
- Contributing toxic chemicals and harmful organic compounds to nearshore waters and sediments.

IV. RECOVERY STRATEGY FOR THE GREEN/DUWAMISH WATERSHED

A multi-species salmonid recovery strategy was developed for the Green/Duwamish watershed using the information collected for this report. The strategy relies heavily upon opening the currently untapped potential for salmonid recovery in the Upper Green River Sub-watershed. Dams have blocked access to 106 lineal miles of stream habitat and about half of the watershed acreage. The Upper Sub-watershed is large enough and the habitat forming processes are still relatively intact or in a process of recovery to allow this area to function as salmonid refugia. This refugia can seed the downstream habitat, with a potential to greatly increase natural salmonid production, especially for coho, chinook, steelhead, and cutthroat salmonids. Implementation of the strategy relies on two critical or key actions: (1) restoration of efficient upstream and downstream fish passage at the dams; and (2) ensuring that the juveniles produced in the Upper Green River Sub-watershed are provided with essential habitat functions in the downstream areas of WRIA 9. In addition, it is essential to protect intact habitats and properly functioning processes that are currently supporting existing salmonid populations throughout the WRIA.

V. NEXT STEPS

The Habitat Limiting Factors and Reconnaissance Assessment Report is the first coordinated step toward salmonid recovery in WRIA 9. It lays the groundwork for a comprehensive conservation planning effort over the next five years. This multi-species effort focuses on habitat issues affecting the decline of salmonids and other species. The planning effort will unfold in four stages over the next five years. Following the Habitat Limiting Factors and Reconnaissance Assessment Report, a Near-term Action Agenda is expected to be completed in 2001. This Agenda will guide interim and immediate actions. Also in 2001, a Strategic Assessment will begin. This will culminate in a report in mid-2003 that will help fill important data gaps. The Comprehensive Conservation Plan is the ultimate product of the WRIA 9 planning process. It will guide long-term salmonid conservation and recovery actions in the watershed. The goal is to have the Comprehensive Conservation Plan approved by the National Marine Fisheries Service and the U.S. Fish and Wildlife Service by June 2005.

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